WEST Search History

Hide Items | Restore | Clear | Cancel

DATE: Tuesday, November 01, 2005

Hide?	Set Name	Query	Hit Count
		DB=PGPB,USPT; PLUR=YES; OP=ADJ	
☐	L11	L9 and l5	1
☐	L10	L9 and l8	0
☐	L9	adaptive (transmission or transport) control	39
☐	L8	L7 and @AD<19991215	1285
☐	L7	l5 and (disgard or disgarding or skip or skipping or drop or dropping)	2889
☐	L6	L5 and l4	2
☐	L5	(differential service) or (priority level)	9337
☐	L4	L3 and (disgard or disgarding or skip or skipping or drop or dropping)	28
☐	L3	L2 and @AD<19991215	48
☐	L2	l1 and MPEG	112
☐	L1	(adaptive or end-to-end) control	5392

END OF SEARCH HISTORY

L4: Entry 8 of 28 File: USPT Apr 10, 2001

DOCUMENT-IDENTIFIER: US 6215766 B1
TITLE: Hierarchical rate control of receivers in a communication system transmitting layered video multicast data with retransmission (LVMR)

Application Filing Date (1):
19980130

Brief Summary Text (2):
The present invention relates to the transfer of video information over the internet or over intranet systems. More particularly, the present invention is directed to a method and apparatus for providing, in the transmission of a video signal, efficient adding and dropping of video layers received by receivers in a data communication system to reduce data interference associated with realtime video distribution.

Brief Summary Text (4):
In recent years, there has been a rapid expansion of the internet and intranets, and significant increase in both computer processing power and network bandwidth. Such infrastructure improvements have introduced opportunities for new multimedia applications over networks, such as video conferencing, distance learning, remote presentation, and media on demand, applications that typically involve realtime video distribution. Approaches proposed to handle the realtime aspect of video distribution over networks fall into two categories: (1) the use of a network capable of resource reservation to provide performance guarantees, and (2) the use of adaptive control to adjust multimedia traffic characteristics to meet the network capacity. Both Research Reservation Protocol (RSVP) and Asynchronous Transfer Mode (ATM), which offer network-level reservations, are not yet available for ubiquitous use in real-time video distribution. Even when reservations are available, there are two reasons to apply adaptation techniques: (1) it is difficult to plan particularly accurate reservations so that some adaptation is required to allow tolerance in reservation accuracy; and (2) in view of the cost of resource reservation, it is more efficient to reserve only enough resources to provide the basic required video quality and to then transmit and add on other enhancement layers with best-effort network support and adaptive control.

Brief Summary Text (7):
There have been two principal approaches employed to address the rate control problem in video multicast: sender-initiated control, and receiver-initiated control. In the sender-initiated approach, the sender multicasts a single video stream whose quality is adjusted based on feedback information from the receivers. The receiver-initiated approach, on the other hand, is usually based on a layered video coding scheme in which the sender multicasts several layers of video (typically a base layer and several enhancement layers) in different multicast groups, and a receiver subscribes to one or more of the layers based on its capabilities. This scheme is "receiver-initiated" in the sense that each receiver determines on its own whether to drop or add a particular enhancement layer.

Brief Summary Text (8):
Comparing LVMR with Receiver-driven Layered Multicast (RLM), both systems deploy

layered video multicast schemes but differ in the mechanisms used for adding or dropping a layer. In RLM, a fully distributed approach is advocated in which a receiver, by itself, makes decisions to add or drop an enhancement layer. This decision is enhanced by a "shared learning" process in which information from experiments (i.e. prior attempts by receivers to add or drop enhancement layers) conducted by other receivers is used to improve performance. Shared learning, although providing an improvement to indiscriminate adding and dropping of layers, requires that each receiver maintain a variety of state information parameters that it may or may not require. In addition, the use of multicasting to exchange control information may decrease usable bandwidth on low speed links and lead to lower quality for receivers on these links.

Brief Summary Text (9):
In LVMR, however, a hierarchical approach in the receivers' dynamic rate control schemes is used to allow receivers to maintain minimal state information and decrease control traffic on the multicast session. LVMR also provides more functionality as compared to simple receiver-driven schemes such as RLM. In particular, it allows multiple experiments to be conducted simultaneously, and also helps to drop, in most cases, the correct enhancement layer(s) during periods of congestion, i.e. to drop those enhancement layers that will alleviate the congestion.

Brief Summary Text (13):
The inventive method and apparatus segregate the network into domains and subnets, with the receivers divided among the subnets based on criteria such as receiver location. Each domain is assigned an intermediate agent (IA) and each subnet is assigned a subnet agent (SA). Add-layer experiment history data derived from prior attempts made by receivers in the network to add video enhancement layers is obtained. The experiment history data contains information concerning successful and failed add-layer attempts made by receivers, such as which video layers were added successfully and/or unsuccessfully under which conditions. The experiment history is communicated from the SA to the IA containing the subnet and is used to allow or deny receiver add experiments so that congestion conditions which affect data rate can be avoided or reduced. The experiment history data is also used to instruct a particular receiver to drop its highest status layer of a particular video signal when a congestion condition is detected so as to minimize the effect on other receivers receiving that particular video signal.

Detailed Description Text (4):
Layered multicasts provide a finer granularity of control as compared to using a single video stream, because a receiver may subscribe to one, two, or more layers depending on its capabilities. If a receiver experiences packet loss as a result of network congestion, dropping one or more layers will reduce congestion and, hence, will reduce potential packet loss.

Detailed Description Text (5):
The inventive hierarchical rate control scheme is designed for utilizing several software and hardware MPEG decoders and provides a simple way to achieve layering in a manner similar to temporal scalability. In MPEG video coding, frames are coded in one of three modes: intraframe (I), predictive (P) or bidirectionally-predictive (B). These modes provide intrinsic layers in that an I frame can be independently decoded, while P frames require I frames to decode and B frames generally require I and P frames to decode. By using a multicast group for each frame type, a simple layering mechanism is obtained.

Detailed Description Text (6):
The choice of layering technique is strongly influenced by the need for easy integration of any scheme with current MPEG-based systems. In the inventive embodiment herein described by way of illustrative example, the layering is implemented as a postprocessing filter for a standard MPEG bit stream. After an

MPEG stream is encoded, a filter passes the output MPEG bit stream to identify markers that demarcate the start of a video frame. Next, the frame type field is decoded and, based on the frame type, bits of the MPEG stream are directed to the appropriate multicast group until the next marker identifies the start of a new video frame. At the decoder, a multiplexer is used to sequence video data from the different multicast groups so that an MPEG decoder is able to decode the resulting multiplexed stream.

Detailed Description Text (33):
5. Collaborative Layer Drop

Detailed Description Text (34):
Typically, if a receiver senses congestion, then it may drop the highest layer that it receives in order to reduce the congestion. However, this practice does not always alleviate congestion in a multicast system because other receivers may still experience congestion. For example, if two receivers R.sub.A and R.sub.B (receiving 2 layers and 3 layers, respectively) are on the same subnet and experience congestion caused by a traffic overload on the shared link, then even if the receiver R.sub.A drops layer 2, congestion will not be decreased until receiver R.sub.B drops layer 3. For efficient alleviation of congestion, therefore, only level 3 should be dropped. Accordingly, the following conditions and results apply in the inventive method to coordinate efficient layer drop between receivers:

Detailed Description Text (35):
i. If a receiver R.sub.A is congested and finds another receiver R.sub.B on the same subnet that is also congested, and L(A)<L(B), then R.sub.A should not drop layer L(A) until after R.sub.B has dropped layer(s) L(A)+1 to L(B).

Detailed Description Text (46):
In table B, three conditions are described to assist state transitions: (1) Congestion-condition, (2) Load-condition and (3) Unload-condition. As stated in Li, X. et al. congestion can be detected by various factors, such as the packet loss rate exceeding a certain threshold, or the percentage of video frames missing deadlines exceeding a threshold. Similarly, if packet loss rate is below a certain threshold, and the percentage of video frames arriving late is below a given threshold, the network is in an unload condition. Any network condition that cannot be categorized either by "Congestion" or "Unload" is denoted by "Load". Periodically, each receiver does some simple statistics on the packet loss ratio and/or frame arrival timing in the past period and matches the result to one of the three conditions. Then state transition takes place after the statistics are obtained. All the timing parameters and constants are in the unit of such "period". In the example described herein the period is set to the time span of a GOP (Group of Picture) of MPEG frames.

Detailed Description Text (49):
A receiver needs to remain in the CONGESTED state for time T.sub.c.sup.i before dropping layer i. T.sub.c.sup.i is set to the default value of T.sub.c,0 except in two cases: (1) immediately following the experiment of adding layer i, T.sub.c.sup.i is set to a smaller value, T.sub.c,add, such that if the newly added layer i brings too high a load to the network, the receiver will detect it quickly and drop layer i; (2) if a receiver (receiving i layers) is in the CONGESTED state and finds another receiver (receiving more than i layers) on the same subnet also congested, then it extends T.sub.c.sup.i =T.sub.c.sup.i +1. The intuition is that if a receiver finds that on the same subnet, another receiver receiving higher layer(s) is also congested, then possibly the congestion is caused by the higher layer(s). So this receiver should wait longer before dropping its own layer.

Detailed Description Text (51):
There are six fundamental operations performed by a receiver in hierarchical rate control: (1) join-session, (2) leave-session, (3) add-layer, (4) drop-layer, (5)

send-cong-msg and (6) pro-cong-msg. Each of these six operations is described below with reference to FIG. 4 and Table B. Note that "leave-session" messages and the operations by IA/SA have not been shown in the state diagram of FIG. 4.

Detailed Description Text (68):
(b) Otherwise the receiver drops layer i, extends S.sub.u.sup.i+1 =T.sub.u.sup.i+1 *.alpha., and multicasts a FAIL (i, T.sub.u.sup.i+1) message on the subnet. Then SA informs IA about the failure of the experiment by the same message.

Detailed Description Text (70):
vi. drop-layer:

Detailed Description Text (71):
If a receiver senses congestion, it may try to reduce its rate by dropping one or more enhancement layers; but this is not always the right approach. For example, with reference to FIG. 3, if congestion occurs on Ln.sub.5 which services R.sub.1, R.sub.2 and R.sub.3, then although R.sub.1 senses the congestion, R.sub.1 should not drop any layer, and R.sub.2 and R.sub.3 should both drop their highest layer (e.g. layer P).

Detailed Description Text (73):
(b) If a majority of SAs report congestion within a short time, the IA requests the highest video layer in the domain to be dropped to decrease the congestion. A DROP (DL.sub.max) message is sent to those SAs that reported CONG(i) within a certain time and i=DL.sub.max. The SAs would multicast the DROP message to the subnet.

Detailed Description Text (74):
(c) After a receiver (receiving i layers) has been in the CONGESTED state for certain time (.delta..gtoreq..sub.Tc.sup.i), or after it hears a DROP(i) message, it drops the highest layer i.

Detailed Description Paragraph Table (1):
TABLE A Parameters and Constants in the State Transition and Protocol Parameter Description .delta. Time counter of how long a receiver has been continuously in certain state T.sub.t Time a receiver needs to spend in the TEMP state before transition to other states. T.sub.c.sup.i Time a receiver need to remain in the CONGESTED state before dropping layer i. T.sub.u.sup.i Time a receiver needs to remain in the UNLOADED state before adding layer i + 1. T.sub.c,0 The default value for T.sub.c.sup.i T.sub.c,add The default value for T.sub.c.sup.i right after a layer-add experiment T.sub.u,min, T.sub.u,max The value for T.sub.u.sup.i. T.sub.u,min is also the default value R.sub.c, R.sub.u Unload-condition: r .gtoreq. R.sub.u. Congestion-condition: r .gtoreq. R.sub.c .alpha. Factor to increase T.sub.u.sup.i if adding layer i + 1 fails. r Packet loss rate during a period (usually a GOP)

Detailed Description Paragraph Table (2):
TABLE B Receiver State Transition Table Transition Description of Transition [1] Send: LAYER_REQ to subnet Receive: LAYER_ACK (1 = SL.sub.max) from SA Action: Join layers 1 to SL.sub.max [1, 1] Condition: .delta. < T.sub.t AND NOT Congestion-condition [2] Condition: Congestion-condition [2,1] Condition: .delta. .gtoreq. T.sub.c.sup.i AND Congestion-condition [3] Condition: .delta. .gtoreq. T.sub.t AND Load-condition [3,1] Condition: Load-condition [4] Condition: .delta. .gtoreq. T.sub.t AND Unload-condition [4,1] Condition: .delta. .gtoreq. T.sub.u.sup.i AND Unload-condition [5] Condition: Congestion-condition [6] Condition: Unload-condition [7] Condition: Load-condition [8] Condition: Load-condition [9] Condition: Unload-condition [10] Condition: Congestion-condition [11] Condition: Congestion-condition AND .delta. .gtoreq. T.sub.c.sup.i Action: drop layer i [12] Condition: Unload-condition AND .delta. .gtoreq. T.sub.u.sup.i Action: add layer i + 1

CLAIMS:

1. A method for hierarchically controlling the transmission rate of a transmitted video signal having layers of data from a sender to a plurality of receivers in a communications network for regulating the addition of video data layers to an existing video signal received by the receivers to thereby form the transmitted video signal, comprising the steps of:

dividing the communication network into domains;

appointing an intermediate agent (IA) for each domain;

dividing each domain into subnets, with each receiver being associated with one of said subnets;

appointing a subnet agent (SA) for each subnet;

gathering, in said SAs, add-layer experiment history data from prior attempts by receivers associated with respective ones of said SAs to add a video data layer to a receiver's respective existing video signal; and

communicating information, based on said gathered experiment history data, from said SAs to said plurality of receivers and to said IAs to provide collected information to said plurality of receivers concerning conditions for adding desired video data layers to, and for dropping video data layers from, each receiver's respective existing video signal so as to avoid network data congestion by preventing video layer addition when certain of said conditions exist and so as to efficiently reduce data congestion by directing specific ones of the receivers to drop selected ones of the video data layers from corresponding existing video signals.

3. The method of claim 1, wherein said video signal data layers are hierarchically designated from a lowest status to a highest status and wherein said step of communicating comprises instructing a receiver, in one of a domain and a subnet, having a greater number of video data layers in its respective existing video signal to drop a data layer having a highest status level in said respective existing video signal when a congestion condition is detected.

6. A device for hierarchically controlling the transmission rate of a transmitted video signal having layers of data from a sender to a plurality of receivers in a communications network for regulating the addition of video data layers to an existing video signal received by the receivers to thereby form the transmitted video signal, comprising:

means for dividing the communication network into domains;

an intermediate agent (IA) associated with each domain;

means for dividing each domain into subnets, with each receiver being associated with one of said subnets;

a subnet agent (SA) associated with each subnet, each of said SAs being in communication with a respective IA associated with a corresponding subnet;

means for obtaining, in said SAs, add-layer experiment history data from prior attempts by receivers associated with respective ones of said SAs to add a video data layer to a receiver's respective existing video signal; and

means for communicating information, based on said gathered experiment history data, from said SAs to said plurality of receivers and to said IAs to provide

collected information to said plurality of receivers concerning conditions for adding desired video data layers to, and for dropping video data layers from, each receiver's respective existing video signal so as to avoid network data congestion by preventing video layer addition when certain of said conditions exist and so as to efficiently reduce data congestion by directing specific ones of the receivers to drop selected ones of the video data layers from corresponding existing video signals.

8. The device of claim 6, wherein said video signal data layers are hierarchically designated from a lowest status to a highest status and wherein said means for communicating comprises means for instructing a receiver, in one of a domain and a subnet, having a greatest number of video data layers in its respective existing video signal to drop a data layer having a highest status level in said respective existing video signal when a congestion condition is detected.

Previous Doc Next Doc Go to Doc#

Previous Doc Next Doc Go to Doc#
First Hit Fwd Refs

Generate Collection

L11: Entry 1 of 1 File: USPT Apr 16, 2002

DOCUMENT-IDENTIFIER: US 6374117 B1
TITLE: Queue based power control scheduling

Detailed Description Text (8):
Many variations of this invention will be apparent to those skilled in the art. For example, this invention can be extended to providing a plurality of different priority levels. Whereas the afore-described embodiment depicts a priority (P.sub.prio) and a non-priority (P.sub.pc) power level, additional intervening levels of priority may be provided by increasing the power level in one or more increments between P.sub.pc and P.sub.prio.

Other Reference Publication (1):
Jianming, W., et al., "Performance Evaluation of Wireless Multimedia CDMA Networks Using Adaptive Transmission Control", IEEE Journal on Selected Areas in Communications, vol. 14, No. 9, Dec. 1996, pp. 1688-1697, XP000639631.

Previous Doc Next Doc Go to Doc#